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THE DISTRIBUTION OF PANDORIANA MAJA CR. IN CENTRAL EUROPE (LEP. NYMPHALIDAE)

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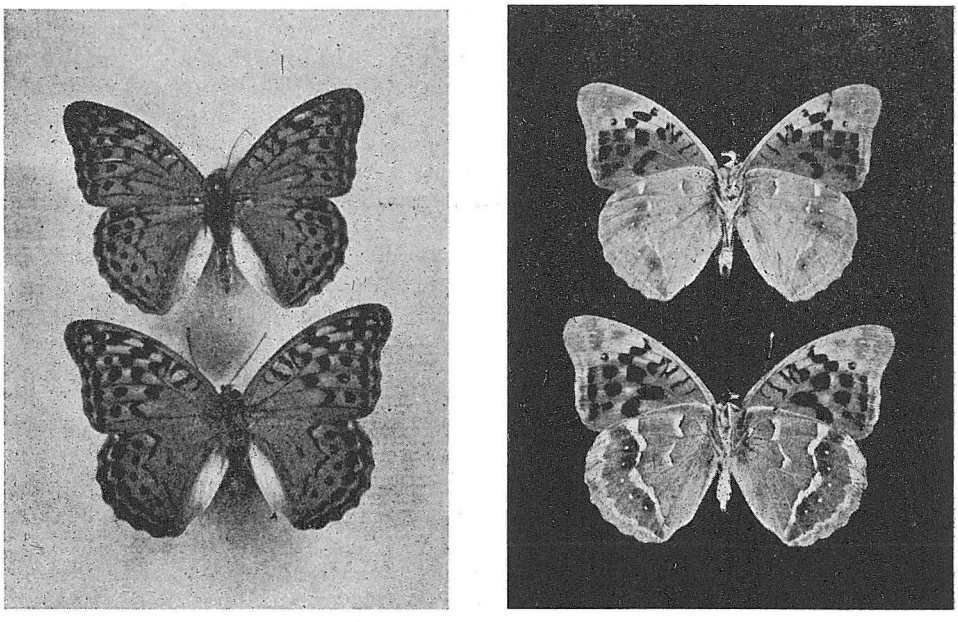
I. Distribution of *Pandoriana maja* CR.

Pandoriana maja CR. is most frequently recorded in the literature under the name of *Argynnis pandora* SCHIFF. (sic.); recte [DEN. et SCHIFF.] Recently the new genus *Pandoriana* WARREN (1942) was established for this species which is also recorded by VERITY (1950). According to the laws of



upperside. underside.

Pair of *Pandoriana maja maja* CR. Therapia near Instabul (June 1913, coll. Marhan, Ent. Dept. of the Nat. Museum in Prague). Photo D. Weiss (Reduced).

priority the correct specific name is *maja*, by which it was named by Cramer (1775) on the basis of specimens from the vicinity of Istanbul, where it occurs abundantly (Pronin 1928, de Lattin 1950). In the collections of the Entomological Dept. of the National Museum in Prague (coll. Marhan) one pair is deposited, labelled June 1913 and as from the locality Therapia situated in the above mentioned area, north of Istanbul, in European Turkey.

Every systematical lepidopterological work shows—at any rate approximatively—the general distribution of *P. maja* Cr. Already Heyne-Rühl (1885) listed many precise localities, some of them from our area. These statements were on the whole taken over from earlier faunistic papers. Seitz (1906) records the area of distribution very briefly and incompletely, especially with little regard to central european countries. He characterises the area inhabitated by this species as follows: „Die Schmetterlinge kommen besonders in den Küstenländern des Mittelmeeres vor, sind in Nord-Afrika, auch auf den Canaren, in Spanien, Süd-Frankreich bis zum Vallis und gelangen da bis an die deutsche Grenze; ferner in Italien, dem Süden von Österreich-Ungarn, der Türkei und Klein-Asien, in Vorder-Asien zum Thian-schan, stellenweise häufig." These statements were also taken over by Seitz from earlier papers, and they form the basis for what was taken over and completed by all later authors. We know relatively many references to the localities from Central Europe and Southeastern Europe, as it is a very striking species. But the information is given mostly in short reports, often of only a few lines. An evaluation of the biotops in connection with the existence of *P. maja* Cr. is actually rarely to be found in the literature. Nobody has dealt so far in any greater detail with the area of distribution and its northern limit in Central Europe. I have therefore tried to assemble the scattered reports of the occurrence of *P. maja* Cr. in this area from various faunistic papers, giving in the main lines also a picture of the distribution of the species in Southeastern Europe. To these reports I add the new localities which I ascertained from the specimens deposited in the collections of the Entomological Dept. of the National Museum in Prague. Further I give the still unknown localities of *P. maja* Cr. according to the written and oral communications of some lepidopterologists whose names are given. I have also listed the localities in which I myself have observed the species, with the description of the characteristic biotops of its occurrence.

After the end of the climatically unfavourable periods *P. maja* Cr. penetrated from the Balkans considerably to the north; in recent time the species penetrates far beyond the reach of the Danubian basin and by the Sarmatic route also into the regions situated north of the Carpathian arc.

In the area of distribution it occurs on the whole connectedly, as it is endowed with a considerable vagility. Only at its northern limit of distribution do we find it reported from advanced individual localities. But these are places where the species appeared quite by chance, due to its active or passive flying-in. Here it does not occur permanently, and thus we cannot speak in this case of disjunctive areas. Thus we also account for its on the whole small inclination to form geographical races.

Ssp. *cyrnea* SCHAW. occurring in Corsica belongs to the insular races. Ssp. *seitzi* FRUHST. (= *chrysobarylla* FRUHST.) lives in the Canary Islands, Sicily, but also in Morocco and in the Aurès Mountains in Algeria; other races described are ssp. *violacea* TRTI. (Cyreneica) and ssp. *pasargades* FRUHST. from northern Persia, Turkmenia and the Alexander Mountains, and newly ssp. *argentifasciata* KOTZSCH from Andarab in the Western Hindukush Mountains (Afghanistan). A revision of these races is necessary, as it is not excluded that some of them may belong to lower taxonomic units and do not correspond with the geographical conception of subspecies. But the revision of these races is not the task of the present paper. The origin of some of them seems to be due to the fact that populations occurring in mountaineous biotops were, even if only imperfectly, isolated from the area of continuous distribution of the species. MAŘAN (1949, pp. 39—40) draws attention to the possibility of the origin of geographical races in this way (also in species distributed over larger areas). In many cases we have here, however, regions very imperfectly investigated with regard to the occurrence of *P. maja* CR.; in a species endowed with so high a degree of vagility it is difficult to assume that it became completely isolated in continental biotops. We have always to keep this in mind in a classification of the geographical races of *P. maja* CR.

The other deviations are based mostly on lustre, intensity of coloration of the ventral side of the anterior wings, enlargement or reduction of the individual spots and the total drawing, corresponding to the normal variation of the species; they are classified as individual forms.

The Relation of *Pandoriana maja* CR. to the Ecological Variability in a Wider Sense

Some authors (VERITY, ROCCI, a. o.) establish in many cases the subspecies on the basis of differences in the number of generations in the course of one vegetation period. Such a group of subspecies, which could lie within the range of the ecological variability in a wider sense, would separate in *P. maja* CR. the northern (or mountaineous) populations from the southern ones. In this case it would come to a division of the species into several ecological races without any more substantial morphological differences. But sometimes it would be impossible even to determine a sharp limit between the geographical distribution of the ecological races separated at this manner. We observe a similar phenomenon also in other groups of ecological subspecies. In species characterised by a greater number of geographical races within a relatively small area with similar climatic conditions it would result in different subspecies (in a geographical sense) belonging to the same ecological race separated according to this principle. A similar case among the *Coleoptera* is *Nebria rufescens**) STRÖM. var. *rufescens* (MAŘAN, l. c., p. 37), where it came to a separation of a form according to a somewhat deviating principle, but this form may belong to different geographical races. Also the position of the locality with regard

*)= *N. gyllenhali* auct.

to altitude plays an important part in the number of generations in the course of one vegetation period; sometimes there are also morphological differences. For the sake of accuracy and to prevent possible misunderstandings it might be advisable to designate the races of *Lepidoptera* established according to the number of generations in one vegetation period by a suitable term.

II. Distribution of *Pandoriana maja* Cr. in Central and Southeastern Europe

In studying the horizontal distribution of *P. maja* Cr. in Central and Southeastern Europe the continuity of the distribution of the known localities in the area south of the Carpathians is immediately apparent. But when we follow the reports on the individual finds in the literature, we can divide the area studied into a number of smaller units according to the quantitative representation of the species. A detailed determination of natural regions is, however, not yet possible, as the whole area is unequally explored in this matter. For these reasons I divided the area studied into following main regions:

1. Balkan peninsula
2. Danube basin
3. Sarmatic region

1. Balkan Peninsula.

In Southeastern Europe *P. maja* Cr. lives in two generations. The spring generation is quantitatively weaker, as usually in *Rhopalocera*. It occurs from the middle of May to the beginning of June; the second generation links up with the preceding one, so that the time of flight is connected till about the beginning of October.

The species ascends to considerable altitudes in this area. In the higher mountains there appears to be one generation only. But there are not here isolated biotops, as *P. maja* Cr. can easily fly up here from lower altitudes; we find such a migration in a vertical direction in *P. maja* Cr. in the whole area of its distribution. In some mountains of the Balkans Drenowski (1929, 1930a, b) studied the vertical distribution of *Lepidoptera;* he placed *P. maja* Cr. in the group reaching into the mountain region, i. e. to an altitude of 1600 m.

From the localities so far known we see that in the Balkans the species is in a horizontal direction absolutely connectedly distributed.

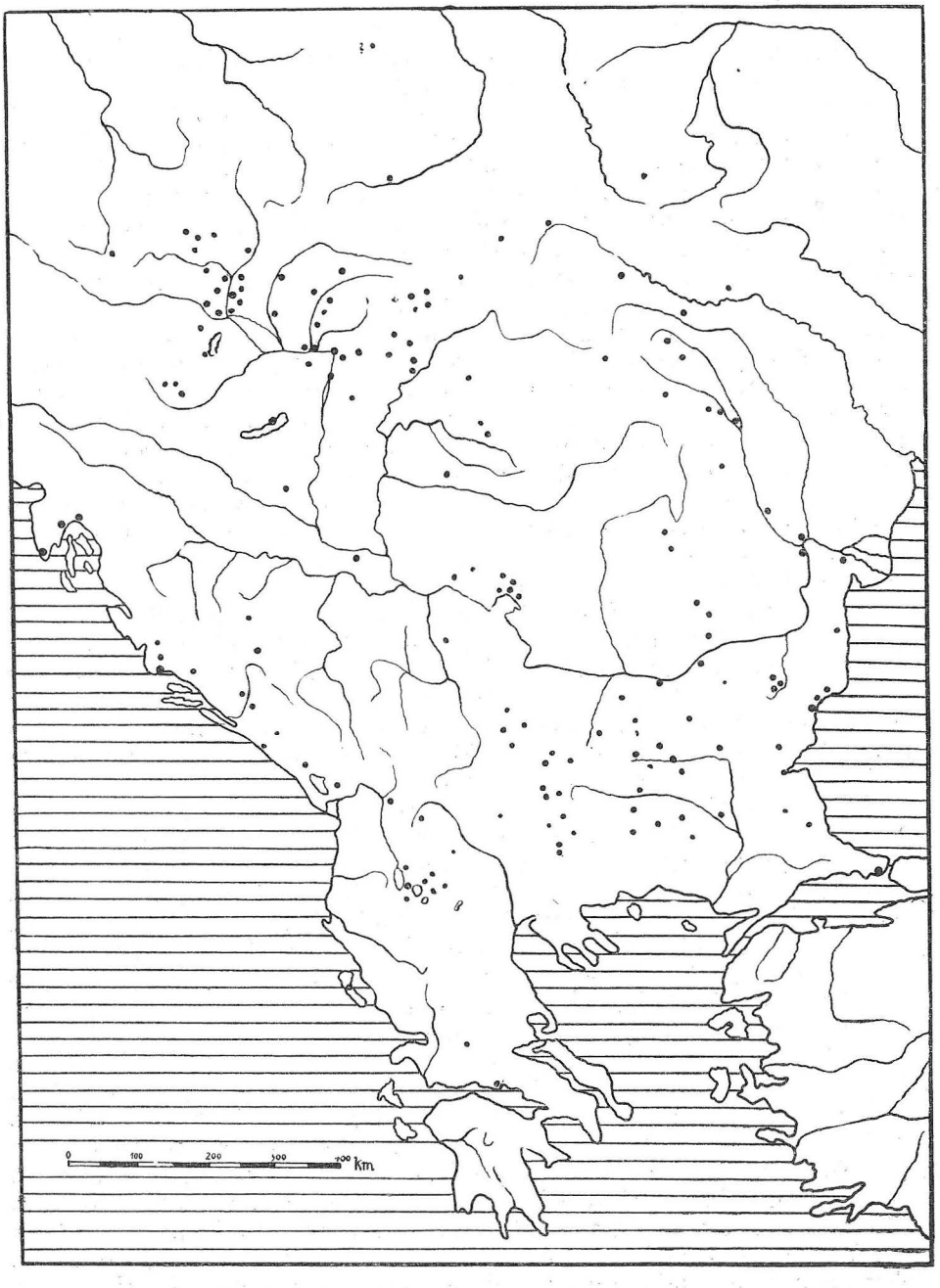
Many authors deal with the fauna of *Lepidoptera* of the Balkans. On the basis of their statements there exist some systematic works summarising until the date of their publication all known localities. Therefore I desisted from copying all these reports and give only the finds published later or those which do not refer to areas systematically worked. I list also the new localities which I ascertained in various collections but did not find quoted in the literature.

The earlier studies of REBEL belong to the principal publications dealing with the faunistic investigation of the Balkan peninsula. REBEL dealt with the *Lepidoptera* of Bulgaria (1903), Bosnia and Hercegovina (1904), and Montenegro, Albania, Macedonia and Thracia (1913), and together with ZERNY he published a more detailed study on the *Lepidoptera* of Albania (1931); from this region the distribution of *P. maja* CR. is known from the upper and middle course of the river Drin. BUREŠ & TULEŠKOV (1928) worked anew and exhaustively the territory of Bulgaria. GRADOJEVIĆ (1930—31) dealt with the western part of the geographical area of the Stredna Gora, to which belong the mountains stretching from the Vitoša —Planina westwards to Beograd, and with the remaining territory of Serbia and part of Macedonia. Everywhere, in Bulgaria as well as in the area studied by GRADOJEVIĆ, *P. maja* CR. is an abundantly occurring species. The authors cite a great number of localities which indicate a connected distribution of the species. SALAY's work (1910) contains a faunistic study of the *Lepidoptera* of Roumania. For the Balkans a fairly considerable number of localities is published here from the Dobrudja and from the lower course of the Danube so that it can be seen that here too the connected area of distribution remains preserved. The other localities relating to the Carpathian region and to the northeastern part of the country are given in more detail in the relevant chapter.

In the south of the peninsula, in the Ionian-Aegean region, distinguished by an exceptionally varied relief GALVAGNI's find (1933) is interesting; he reports one specimen already in the first half of May from Delphi at the Corinthian Gulf. REBEL (1910) describes the abundant occurrence of the species in the park of the Achilleion on the island of Corfu. In the mountain system of the Pindos, ZUKOWSKY (1937) ascertained *P. maja* CR. together with f. ind. *dacica* HORM. in the Veluchi Mountains.

The same author (1935) cites from Macedonia the occurrence of the species at Petrovo and Salihaga, where also f. ind. *dacica* HORM. occurs abundantly. REBEL (1913) reports Bitolj as the only locality in this region. DRENOWSKI (1930) and THURNER (1938) studied lepidopterological conditions in the immediate vicinity of the Macedonian lakes, where *P. maja* CR. occurs in some closely connected localities. A series of *P. maja* CR. from this region is deposited in the collections of the Entomological Dept. of the National Museum in Prague (coll. SILBERNAGEL). 4 ♂♂ are labelled as from the locality Ochrid; of these three belong to f. ind. *lilicina* OBERTH. (21. VI.—30. VI. 1936, leg. SILBERNAGEL). 5 ♂♂ and 4 ♀♀ were found in the Galičica-Planina at an altitude of 1600 m. above sea level (6. VI.—21. VII. 1936, leg. SILBERNAGEL); only 1 ♂ belongs to this form. At higher altitudes there is apparently only one generation in the course of the vegetation period. Similar conditions exist certainly also in the Suha Gora, where *P. maja* CR. occurs at an altitude of 1700 m above sea level (GRADOJEVIĆ l. c.), which is the highest locality found so far in the area studied.

A larger number of localities is known from the coastal region of the Adriatic Sea, from Dalmatia as well as from Istria. Especially the latter region is very important for this species from a geographical point of view. STAUDER (1922) published the localities of both littosial areas; for Dalmatia



The cartogram shows an intuitive survey of the known localities of *Pandoriana maja* Cr. in Central and Southeastern Europe. J. Moucha orig.

he lists: Slivno, Perković and Dernis where the species is abundantly represented, while it lacks at Split. Already REBEL (1904) pointed out the scanty occurrence of *P. maja* CR. in this region; nevertheless the species is here connectedly distributed; as he himself pointed out it is found at Trebinje. SCHINDLER's collection (in Mus. Nat. Pragae) contains from there one pair labelled as from the locality of Dubrovnik. STAUDER (l. c.) collected *P. maja* CR. on the island Brač. Farther from the coast the species is known from the basin of the Neretva at Mostar (REBEL 1904, GIBBS 1913) and Domanović (REBEL 1904, HOLIK 1951). From the latter locality 3 ♂♂ are deposited in the collections of the Entomological Dept. of the National Museum in Prague (21.—24. VII. 1930, leg. HOLIK).

From Bosnia REBEL (1904) lists the locality of Dervent, and SCHAWERDA (1908) reports non-numerous finds from Foinica and Vućija Bara, where he places the limit of the vertical distribution in an altitude of 1250 m above sea level. The same author (SCHAWERDA 1912) collected here later also f. ind. *paupercula* RAG. One ♂ of this form from Fruška Gora is deposited in the collections of the Entomological Dept. of the National Museum in Prague (coll. Exped. Mus. Nat. Pragae, 1. VI. 1947). SEYER (1938) collected *P. maja* CR. in the environs of the Plitvica lakes.

It has already been said above that Istria is a geographically important region for *P. maja* CR. According to the reports of REBEL (1911 and 1913) and STAUDER (l. c.) we can follow a chain of localities proving that the species is here known not only from Rjeka and from the littoral mountains Učka Gora (= Monte Maggiore) but also from the island region and southern Istria (Pula). Thus there is here a connection with the subalpine Julian lowland. Here we have beyond doubt a mixing of the populations of the Balkan and Apennine penisulas.

From this region *P. maja* CR. penetrates to the northeast via the Croatian-Slavonian upland to the Danube basin. One ♂ labelled as from the locality of Rakovica is deposited in the collections of the Entomological Dept. of the National Museum in Prague (coll. SOFFNER).

The species is very rare in Carinthia and East Tyrol, worked systematically by THURNER (1948), and only a few finds are known from three localities: Sattnitz, Nötsch (flood plain of the Gail), and Mittelpreth. The specimens are characterised as follows: „... kleine Tiere mit reduz. Silberzeichn. a. d. der Hfl.-Unterseite". They are with a high degree of probability some specimens flown here by chance as proved also by the very rare occurrence of the species.

From the frontier region of Styria (Austria) and Slovenia (Yugoslavia) HOFFMANN-KLOS (1914) report also that *P. maja* CR. occurs here only extremely rarely at Radkersburg and in its immediate vicinity. These cases show that *P. maja* CR. penetrates also into the high mountains, of course quite rarely and in a very small number of individuals, as can be seen not only in the Alps but also in the Carpathians.

SALAY's paper cited above deals with the distribution of *P. maja* CR. in the region of the lower course of the Danube. Several authors (FRIVALDSZKY 1873, and 1877, ROSA 1909, REBEL 1911, a. o.) list localities near

the Iron Gate: Orsova, Suscului, Mehadia, Baile Herculane, and Turnu-Severin, and farther west Oravita and Grebenat. The species is here everywhere abundant, together with f. ind. *dacica* HORM. From the littoral region of the Dobrudja (Bulgaria) the locality of Balčík (CARADJA 1930) is known, where besides other finds one ♂ was found still on September 8.

This brief characterisation of the distribution of the species in the Balkan peninsula shows that it occurs here quite connectedly and as far up as into the mountain region (1700 m).

2. Danube Basin

The occurrence of *P. maja* CR. in the region of the Danube basin shows that the species is indifferent to the substratum. We find it in areas of sedimentary origin as well as on volcanic rocks, without regard to the geological composition of the substratum. This in addition to the properties already mentioned increases the possibilities of the spread of its area.

V. B. POLÁČEK in his paper "Butterflies of Slovacia" (in litt.) dealt with the published records of localities of *P. maja* CR. on the territory of Slovakia and in another paper "Zoogeography of the Lepidoptera in the Carpathians" (in litt.) he gives various records from the region of the Carpathians, from which it is evident that the species is here quantitatively not so strongly represented as in the Balkans. It appears, however, that this relatively rare occurrence is only a secondary one, and was brought about after the settlement of this area by the species. Its decrease was caused by intensive agriculture. The biology of the imago is well known. The imago lives for quite a long time and is bound to the occurrence of flowering *Composites* (especially of the genera *Carduus* and *Cirsium*), to which it flies from considerable distances. In tilled culture steppes these plants are, however, usually lacking or they are destroyed at harvest-time, which in these regions coincides with the time of the maximum occurrence. Therefore we find here *P. maja* CR. relatively rarely, whereas in localities where the above-mentioned plants flower permanently it often flies in masses, as I had opportunity to observe in the Kováčov Hills (MOUCHA-WEISS 1951), also in the flood-plain groves of the Danube, e. g. near the village of Čenkov (env. Štúrovo), etc.

As already said this region is not optimal for the occurrence of *P. maja* CR. The untilled lands are mostly pastured by cattle and near the rivers they are swampy or inundated. They do not offer favourable living conditions for a species which prefers dry (to arid) localities where the nourishing plants of the imago flower. As far as these flower also in wetter meadows we find the species in a limited number also here (VALENTA 1940).

This is why especially from the Alföld we know on the whole few localities. The locality most frequently cited in the literature is Peszérpuszta (JONES 1907, GURNEY 1913, and DANIEL-LORENZ 1929), where *P. maja* CR. flies abundantly already from the end of June. The occurrence of the species at Füzesabony and Debrecen was known already to the earlier authors (TÖRÖK 1866, MOCSÁRY 1876, a. o.). The region of the Great Pannonian Lowland includes also the locality of Ötvenes (on the lower course of

the river Maros) whence one pair is known, deposited in the collections of the Entomological Dept. of the National Museum in Prague (coll. HOLIK).

The localities Baile Felixe (MOCSÁRY 1876) and Oradea (HORVÁTH-PÁVEL 1876) situated farther north belong geographically to the western promontory of the Bihor, separated from the southern part of the Carpathians by the middle course of the river Maros.

The northern margin of the Alföld is bordered by the mountain system of the Matra, whence are known the localities of Eger, Parád, and Pétervásár (HORVÁTH-PÁVEL l. c.). GAÁL (in litt.) introduces a number of localities, showing a compact distribution of *P. maja* CR. in the area of the North-Hungarian mountains. The most common occurrence of this species is recorded in the Bükk-Mts. In the promontory of this mountain was ascertained as a common one on several localities also (Felsö-Tarkány, Noszvaj, Nagy-Visnyó, Uppony, Hámor and Lillafüred). In the hills situated to the west of this mountain-system *P. maja* CR. lives compactly too; localities communicated by GAÁL to me demonstrated the direct connection with the area of numerous occurrence of that species in Kováčov-Hills. These localities are as follows: Börzsöny-Mts., Szokolya, Diósjenö, Nagymaros, Szob, NagySzál-Mt. (near Vác), Kosd, Czerhát-Mts., Szizák, Bér. To these records we must add also the localities Bajót and Bánhida (right bank of the Danube). The ennumeration of localities results the fact *P. maja* CR. prefers the hills to the tilled ground in this region.

Many finds are reported from Budapest and its immediate vicinity (AIGNER-ABAFI 1907, GURNEY l. c., ZERKOWITZ 1927, BECKER 1932, a. o.). In the collection of the Entomological Dept. of the National Museum in Prague are deposited one ♂ labelled as from this locality (coll. LUMPE) and a further specimen collected at Vác in July 1924 (one ♀, coll. GROSSE).

The southern and western part of the Danube Lowland is on the whole imperfectly known with regard to the distribution of *P. maja* CR. as well as its further spread under the reach of alpine influences. Only a few localities are reported from here; thus Pécs in the south (NENDTVICH 1846, HORVÁTH-PÁVEL l. c.), then the peninsula Tihany in Lake Balaton (GRAESER & SZENT-IVÁNY 1940); and the northwestern part of the Lowland is represented by the locality of Sopron (SIMONICS-VIDÁK 1856).

A zoogeographically important region is that given by the distribution of *P. maja* CR. on the upper course of the Danube, as the localities here explain also the very rare occurrence of this Mediterrannean species in Central Europe. Its very perfectly developed vagility shows us the routes by which also other resistant Mediterranean and Pontian species endowed with vagility spread to Central Europe.

In southwestern Europe we find *P. maja* CR. not only in southern Switzerland (VORBRODT 1931) but also in Bavaria, north of the Alps (SPULER 1908). Of these German finds WARNECKE (1927) remarks that they are flown-in specimens, and this agrees also with the knowledge of the occurrence of the species in the region of the upper course of the Danube. The Rhineland and Bavaria are zoogeographically important areas for the occurrence of *P. maja* CR., which penetrates to here by two routes. The

Rhineland has populations penetrating from the South or also directly from western and central France.

The second route of the species to the regions lying north of the Alps follows the upper course of the Danube; this latter area was studied lepidopterologically by GALVAGNI-REBEL-ZERNY (1915), who characterise the district inhabited by *P. maja* CR. as follows: „. . . östl. Bruchrand der Alpen, Wiener Wald, Hainsburger Berge, Donauauen, N.-Kreuzstetten, Wachau, Böhmisch-mähr. Höhe." By this latest name the authors designate the part of the upland situated in Austrian territory (north of the Danube). The characterisation of the distribution of *P. maja* CR. was taken over in later lepidopterological works on this region, and supplemented by more accurate data for the individual localities, to which I wish to add only Kreuzenstein and Leopoldsberg (MUHR in litt.), which, however, fall within the limits of the above—mentioned territory. To this region we can place also Řimov near České Budějovice where 8. VIII. 1936 SCHACK (1936) ascertained one ♀. It is certainly a flown-in specimen, as the biocenosis of southern Bohemia are not favourable for an autochthonous occurrence of Mediterrannean components of the type of *P. maja* CR. From this point of view we have to classify this so far only find of *P. maja* CR. in Bohemia. The Moravian localities are closely connected with the territory around the upper course of the Danube. In the Hills of Pálava the specimens live perhaps permanently (HOLIK l. c.). But it penetrates also to places situated farther north, though only rarely in sporadic specimens, especially in climatically favourable years. So far only a few localities are known: Třebíč, Polešovice (ADÁMEK 1938), Brno (HEYNE-RÜHL l. c. SKALA 1912), Vacenovice (HACHLER 1942), Senorady, Ivančice (LEMBERK 1939), and the serpentine steppe at Mohelno (POVOLNÝ 1945). According to an oral communication SCHWARZ observed the species abundantly at Gbely at the Moravo-Slovakian border. VALA (in litt.) cites from the Bílé Karpaty the find of one ♀ at the locality Vlára—Sv. Sidonie.

Incomparably more abundant is *P. maja* CR. represented in the western part of the Carpathian system, where the area of distribution ascertained can be divided into several regions.

The Malé Karpaty have been best studied from the point of view of the distribution of *P. maja* CR. Already BAUER (1926) draws attention to the occurrence of this species; he gives the find of two specimens on the Veterlin Mt. VALENTA (l. c.) studied this region in detail; he followed especially the biology of the imago; he listed a number of plants visited by the imago. *P. maja* CR. flies here connectedly in the whole southern region of the Malé Karpaty; it lives especially in the valleys (250—300 m), but sporadically rises also to the summit of the Baba in the direction towards the summit Čmel (709 m above sea level).

The same author lists several localities from the sands of the Záhorská Lowland where he observed in 1935 one specimen also in the autumn, on October 1st. From Bratislava and vicinity the species was known already to the earlier authors (RÓZSAY 1878, BOGSCH 1892, ORTVAY 1902). MÉRY (1874) gives the locality of Györ. It has already been said that the species is not abundant in the Danube Lowlands; my search for a connected distribution

of the species in southern Slovakia has so far been negative. I ascertained *P. maja* CR. only in a few, narrowly delimited places: the floodplain grove at Čenkov, district of Štúrovo (12. VII. 1948, abundant), on the forest road at the village of Pribeťa (30. VI. 1949, fairly abundant); *P. maja* CR. occurs the most abundantly in this region at Štúrovo and in the Kováčov Hills, where also f. ind. *paupercula* RAG. is abundant (MOUCHA 1949).

In the other localities the species is by far not so abundant as proved by the remarks in the literature mentioning the finds of isolated specimens. From the lower Váh valley we know only Kočovce (VÁNGEL 1886, PAZSICZKY 1910). More recently PONEC (1950) cites from the lower course of the Váh one locality (Šoporňa); he dealt with the vertical distribution of the species in the Smolenické kopce and Kremnica Mts., where he placed the limit of distribution in a vertical direction at an altitude of 1100 m at Kremnica. In the unfar Vtáčník Mts. SLABÝ (in litt.) observed the species close under the summit (1340 m). The same author collected *P. maja* CR. below the Sitno Mt. on its southern side, between the well-known localities of Bátovce (RŮŽIČKA 1931) and "Tanád" near Banská Štiavnica (PETRICSKÓ 1892).

Another region forming part of the northern limit of the area of distribution of *P. maja* CR. is the Slovakian Karst; SZENT-IVÁNY (1937, 1938a, b) cites in several papers Šankovce near Šafárikovo. In the beginning of July 1951 we (MOUCHA, NOVÁK, SLABÝ, SLÍPKA) ascertained several specimens at the Domica Cave. Already GEYER (1877) mentions the occurrence of the species in this region, without defining the locality more accurately ("Rožňavsko").

On the southern side of the Slovenské Rudohorie Mts. SLABÝ (in litt.) collected *P. maja* CR. at Jelšava. In the mountains proper we ascertained one very interesting locality. At the village of Biele Vody near Dobšiná NOVÁK caught one ♀ (16. VII. 1951); the same day we observed here among others: *Erebia ligea* L., *Agapetes galathea* L., *Maniola jurtina* L., *Coenonympha pamphilus* L., *Boloria dia* L., *Mesoacidalia aglaja* L., *Fabriciana phryxa* BGSTR., *Issoria lathonia* L., *Melitaea athalia* ROTT., *Plebejus argus* L., *Maculinea arion* L., *Iphiclides podalirius* L., *Parnassius mnemosyne* L.! (one ♀ only), *P. apollo* L., *Leptidea sinapis* L., *Pontia daplidice* L., *Coalis hyale* L., *C. crocea* FOURC. and *Odezia atrata* L.

The origin of the specimens ascertained in July and August at Olchowa (ROMANISZYN 1929) is not clear, as it is not excluded — or rather as it is probable — that we have here an immigration from the Danube basin rather than a flying-in by the Sarmatic route. But so far we have no connecting link between this locality and the region of the Danube basin. Olchowa lies almost halfway between Borkút near Prešov (HUSZ 1881, Danube basin) and Sambor (ROMANISZYN l. c., Sarmatic region).

The localities enumerated from the region of the upper course of the Danube and from the western part of the Carpathians show us sufficiently accurately the routes by which the species penetrates into Central Europe. Here it is no longer possible to observe a connected area of distribution as on the Balkans, instead we find individual localities in the form of northern outposts, especially along the river courses. But for small excep-

tions (Malé Karpaty, Kováčov Hills) the species lives here on the whole not abundantly and a quantitatively stronger occurrence can be observed only in favourable years. This part of the northern limit of the area is formed by a population penetrating into Central Europe from the Danube basin, which is the real centre of the Central European population of *P. maja* CR. The West European population may appear in the localities north of the Alps (Munich, Bavaria); but there are here only flown-in individuals, i. e. not an independent autochthonous subspecies. Also the other part of the northern limit of the distribution of the species is of an oscillating character dependent on the climatic conditions of the different seasons, sometimes only summers. The localities listed where it lives unusually abundantly form a kind of islands of permanent occurrence of the species. This applies especially to the Kováčov Hills whose flora and fauna are reminiscent of some Mediterrannean forest-steppe localities. *P. maja* CR. penetrates by an entirely different route into the northwestern part of Central Europe.

3. Sarmatic Region

It has already been shown that *P. maja* CR. lives connectedly in the whole of the Balkans. It spreads in two main directions to the north: through the Danube basin to Central Europe and by penetration from the Sarmatic region into the eastern part of Central Europe.

The two routes are sharply separated from each other by the Carpathian arc. In the southern region *P. maja* CR. penetrates fairly deep into the mountains as shown by the localities mentioned from the Iron Gates, further Azuga (CARADJA 1895, SALAY l. c.), and it even penetrates through the gaps into the Transylvanian region (Stalin, formerly Brasov), where BECKER (1932) observed the species at an altitude of 1050 m above sea level. These are localities of the aquilonarian outpost zone advanced in suitable biochores to considerable altitudes.

To the north the species penetrates along the rivers Siret, Prut, Dnistr and their tributaries flowing through Moldavia, Bessarabia and Podolia, and perhaps as far as into the basin of the Vistula. HORMUZAKI, who dealt with the lepidopterology of the Bukovina (1897a, b), points to several localities which are important for the knowledge of the spread of the species in the Sarmatic region: Rož near Černovcy, Zučka (also given by PAWLITSCHEK 1902), Kupka and Corceşti near Radauţi. From this region f. ind. *dacica* HORM. has been described. It will be possible to decide the taxonomic value of this form only on the basis of a more thorough knowledge of the comparative material, which is not accessible at present. The form occurs abundantly together with the type in some localities: Dulceşti (HEYNE-RÜHL l. c., HORMUZAKI 1893), Broşteni-Barnari (SALAY l. c.), Piatra Boica near Borsa and Tarnita; at the latest named locality lives *P. maja* CR. with *Parnassius apollo* L. and *Argyronome laodice* PALL. (1476 m above sea level, PAX 1907). ALEXINSCHI (in litt.) reports f. ind. *paupercula* RAG. together with the preceding form and with the type from the neighbourhood of Tecuci.

There are very few localities lying farther north and many have to

be accepted only with considerable caution, e. g. Stanislaviv (ROMANISZYN l. c.).

KUNTZE-NOSKIEWICZ (1938) worked the zoogeography of Podolia; for *P. maja* CR. from this area they give some places of occurrence taken over from earlier papers. They cite also KORB's find, which is the most northerly place of occurrence given for Central Europe. The locality "between Lódz and Zgierz" is very doubtful and ROMANISZYN (l. c.) queries the correctness of this find, which has been neither verified nor confirmed. The same author had no opportunity to revise either the find reported from Cracow (Kraków), but PRÜFFER (1933?) did not take a negative attitude to it, cited it again, but remarked that he had no opportunity to confirm the report. In the area of the upper course of the Dnistr are several confirmed finds from Olchowa and Sambor (ROMANISZYN l. c.).

Of the earlier authors GARBOWSKI (1892) cites *P. maja* CR. from this area and gives at the same time as already mentioned Kraków (one specimen) and Brody as the northern localities in Central Europe, which is far more acceptable than the unconfirmed find of KORB as the species could easily get here from the southern part of the Bukovina, where it is already abundant.

III. Conclusion

In modern time considerable attention has been given to the migration of insects, especially of *Lepidoptera*. The spread of the areas of species endowed with vagility is one of the part-problems of this study. Every animal tries to gain the greatest possible area of distribution. At the end of each glacial period many species penetrate anew to their original habitats or also still farther to the north.

As far as *Pandoriana maja* CR. is concerned we find many reports in the literature on its occurrence; thus it is possible to determine more accurately the routes by which it spread to the region of Central Europe, and this is also made possible for this species by many other features. The species is endowed with a considerable vagility, is indifferent to the substratum, has a widely spread type of nourishing plants (*Violaceae*), etc. Slovakia by its geographical position veritably asks for a study of the northern limit of Mediterrannean and Pontic elements of the fauna and flora. Before it will be possible to determine more accurately this limit in general it is necessary to become acquainted with it for the different species separately.

The spread of insects over larger and larger areas is often also caused by man himself; classical examples for *Lepidoptera* are the introduction of the North American species *Danaus plexippus* L. into England and *Hyphantria cunea* (DRURY) into Central Europe and Japan. Often these species become pests, as they do not find natural enemies in the new environment. The spread of the area depends for these introduced species also on many other factors such as climate, vitality of the species, etc.

In the present paper I have tried to show the conditions which make the existence of the Mediterranean species *Pandoriana maja* CR. possible in Central Europe, and the routes by which this species reaches Central Europe.

Literature

Adamczewski S., 1939: Contribution à la connaissance des Lépidoptères de la Podolie Polonaise; Fragm. Faun. Mus. Zool. Polonici, 4: 159—209, Warszawa.

Adámek A., 1939: Zajímavé úlovky motýlů z olomouckého okolí. Interessante Lepidopteren aus der olmützer Umgebung; Ent. listy (Folia entomologica), 2 (1938 až 1939): 64—64, Brno.

Aigner-Abafi L., 1907: Magyarország pillangói. Die Tagfalter Ungarns; Rovartani Lapok, 14: 109—116, Budapest.

Alberti B., 1922: Beitrag zur Kenntnis der Macrolepidopterenfauna Mazedonien; Zeitschr. f. wiss. Insektenbiologie, 17: 33—73, Berlin.

Bauer J., 1926—28: Beitrag zur Lepidopterenfauna der Kleinen Karpathen, der Umgebung von Hainburg, Theben und Preszburg; Ent. Anz., 6: 137—140, 148—150, 157—159, 164—166, 172—173, 180—181, 185—189, Wien; Lep. Rundschau 1: 160, 165—167, 183—184, 189—192, 2: 85—88, Wien.

Becker F., 1932: Schmetterlingsfang in Siebenbürgen; Int. Ent. Ztschr., 25 (1931—32): 490—495, Guben.

Binder A., 1933: Schmetterlingsjagd auf dem Balkan (Sommer 1932); Ibid., 27: 335—339, 349—351, Guben.

Bogsch J., 1892: Pozsony vidékének lepkéi. A Pozsonyi Állam Förealiskola Értesítöje az 1891—92 iskolai évröl, pp. 3—15, Pozsony.

Bureš I., 1915: Prinos k peperudnata fauna na Trakija i Makedonija; Spis. na Bulg. Akad. na nauk., 12: 37—54, Sofija.

Bureš I. & K. Tuleškov, 1928: Horizontalnoto razprostraněnije na peperuditě (Lepidoptera) v Bulgaria. Die horizontale Verbreitung der Schmetterlinge (Lepidoptera) in Bulgarien; Izv. na carskitě prirodonaučni instit. v Sofija. Mitteilungen aus den königl. naturw. Instituten in Sofia-Bulgarien, 1: 145—250, Sofija.

Caradja A., 1895: Die Groszschmetterlinge des Königreiches Rumänien; Deutsche Ent. Ztschr., 8: 1—102, Dresden.

Caradja A., 1930: Beiträge zur Lepidopterenfauna Grossrumäniens für das Jahr 1930; Acad. Româna, Memoriile Secţiunii Ştiintifice, 1931: 1—51, Bucureşti.

Cosmovici L., 1892: Contributions à l'étude de la faune entomologique roumaine; Le Naturaliste 14 (6: s. n.): 254—256, 264—264, 280—281, Paris.

Cramer P. and [in part] C. Stoll [1779—1791], "1779" [1775]—1791: Papillons exotiques des trois parties du monde l'Asie, l'Afrique et l'Amérique [Le titre et le texte sont aussi en néerlandais.]; Amsterdam, S. J. Baalde; Utrecht, Barthelemy Wild, "1779" [1775—1776], vol. 1, pp. [4]+I—XXX, 1—16, 1—155+[4], frontispice et pls. 1—96 (coloriées); "1779" [1777], vol. 2, pp. [4]+1—152+[4], frontispice et les pls. 1—96 (coloriées); "1779" [1777], vol. 2, pp. [4]+1—152+[4], frontispiece et les pls. 97—192 (coloriées); "1782" [1779—1780], vol. 3, pp. [8]+1—36, 73 [sic], 38—176+[2], frontispice et les pls. 193—288 (coloriées); "1782" [1780—1784], vol. 4, pp. [4]+1—252, 1—30+[2], les pls. 289—400 (coloriées). Supplément à l'ouvrage, intitulé les papillons exotiques, des trois parties du monde l'Asie, l'Afrique et l'Amérique; par M. Pierre Cramer, contentant les figures exactes des chenilles et des chrysalides de Suriname; comme celles plusieurs rares et nouvellement découvertes papillons et phalènes. Amsterdam, Nic. Th. Gravius "1791" [1787—1791], vol. 5, pp. [4]+I—VIII, 1—67, 60 [sic], 69—181, 382—384, les pls. 1—42 (coloriées), Amsterdam, Utrecht.

Daniel F. & K. Lorenz, 1929: Beiträge zur Lepidopteren-Fauna Zentral-Ungarns; Mitt. d. Münch. Ent. Ges., 19: 335—346, München.

DIMITROV A., 1909: Peperuditě ot Bitolskata okolnost; Period. spis. na Bulg. Akad. na nauk., 1—2, Sofija.

DIÓSZEGHY L., 1935: Die Lepidopterenfauna des Retyezatgebirges. Nachtrag I.; Verh. u. Mitt. d. Siebenb. Ver. Naturwiss. zu Hermannstadt, 83—84 (1933—34): 107—126, Hermannstadt.

DOFLEIN F., 1921: Mazedonien, Jena.

DRENOWSKI A., 1929: Lepidopternata fauna po visokitě planini na Bulgaria II. Die Lepidopteren-Fauna auf den Hochgebirgen Bulgariens II.; Sbornik na Bulg. Akad. na nauk., 25: 1—76, Sofija.

DRENOWSKI A., 1930a: Izsledovanija vrchu lapidopternata fauna na Osogova planina. Untersuchungen über die Lepidopterenfauna des Ossogowagebirges in W. Bulgarien (mit 2 Karten-Schema); Ibid. 26: 1—83, Sofija.

DRENOWSKI A., 1930b: Prinos k Lepidopternata fauna jugozapadna Makedonija. Beitrag zur Lepidopterenfauna S. W. Makedoniens (mit 1 Karten-Schema); Spis. na Bulg. Akad. na nauk., 42: 129—177, Sofija.

FRIVALDSZKY J., 1873: Állat-és növénytani értekegések. Állatani kirándulásaim Orsova, Mehádia és Korniareva vidékein; Magyar orvosok és természetvizsgálók munkálatai, 16: 197—243, Budapest.

FRIVALDSZKY J., 1877: Adatok Termes-és Krassó megyék faunájához. Jelentés az 1874-ik év nyarán e megyékbe tett állanttani kirándulásról. Data ad faunam Hungariae Meridionalis commitatuum Temes et Krasso; Mathem. és természettud. Közlem., 13 (1875—76): 285—378, Budapest.

GAEDE M., 1932: (Die Gattung) Argynnis. In: Seitz, Groszschmetterlinge d. Erde, Paläarkten, Suppl., 1: 227, Stuttgart.

GALVAGNI E., 1933: Griechische Falter, insbesondere über die auf der Griechenlandreise der Univ. Wien, Ostern 1933, 8.—23. April beobachteten Schmetterlinge; Ztschr. d. Öst. Vereines, 19: 74—76, 20: 5—7, Wien.

GALVAGNI E. & F. PREISSECKER, 1912: Die lepidopterologischen Verhältnisse des niederösterreichischen Waldviertels, I. Jahres-Bericht d. Wien. entom. Vereines, 22 (1911): 1—168, Wien.

GALVAGNI E. & H. REBEL & H. ZERNY, 1915: Prodromus der Lepidopterenfauna von Niederösterreich (mit 1 Landkarte); Abh. k.-k. zool.-bot. Ges. in Wien, 9: 1—221, Wien.

GARBOWSKI T., 1891: Beitrag zur palaearktischen Rhopalocerenkunde; Societas entomologica, 5 (1890—91): 169—170, Zürich—Hottingen.

GARBOWSKI T., 1892: Materialen zu einer Lepidopterenfauna Galiziens, nebst systematischen und biologischen Beiträgen; Sitzungsber. d. K. Akad. d. Wissen. Wien (Mathem.-Naturw. Klasse), 101: 869—1004, Wien.

GEYER G., 1877: Állatphaenologiai adatok melyeket alulirott Rozsnyón (Gömörmegye) és környékén az 1868—69, 70-és 71-iki években gyüjtött. Zoophaenologische Beobachtungen gemacht in den Jahren 1868—69, 1870 und 1871 in Rosenau (com. Gömör) und seiner Umgebung durch Unterfertigten. III. Lepidoptera, melyek Rozsnyón és környékén (felsö Sajóvölgy), észleltettek — beobachtet in Rosenau und seiner Umgebung (oberes Sajóthal); A Magyarországi Kárpátegyesület Évkönyve — Jahrb. d. Ung. Karpathen-Vereines, 4: 2—32, Késmárk.

GIBBS A. E., 1913: Butterfly-hunting in the Balkans; Entomologist 46: 122—130, London.

Gradojević M., 1930—31: Prilog lepidopterskoj fauni Jugoslavije. Leptirovi Srbije-Diurna. Les papillons de Serbie-Diurna; Glasnik Jugosl. Entom. Društva, 5—6: 133—153, Beograd.

Graeser F. & J. Szent-Iványi, 1940: Beitrag zur Kenntnis der Lepidopterenfauna der Halbinsel Tihany. Adatok a Tihanyi félsziget lepkefaunájának ismeretéhez; A Magyar biologiai kutatóintézet Munkái — Arbeiten des ung. biologischen Forschunginstitutes, 12 (1940): 213—244, Budapest.

Gurney G. H., 1913: A moth's collecting in Hungary; Entomologist 46: 158—164, London.

Gussich B., 1923: Ein Beitrag zur Rhopaloceren-Fauna Serbiens; Verh. d. zool.-bot. Ges. in Wien, 72: 12—13, Wien.

Hachler E., 1942: Příspěvek k studiu jihomoravských Lepidopter (mit deutscher Zusammenfassung); Ent. listy (Folia entomologica) 5: 89—118, Brno.

Heyne J. & F. Rühl, 1895: Die palaearktischen Groszschmetterlinge und ihre Naturgeschichte, Leipzig.

Hoffmann F. & R. Kloss, 1914: Die Schmetterlinge Steiermarks; Mitt. d. Naturw. Vereines f. Steiermark, 50: 251—252, Graz.

Holik O., 1951: Argynnis pandora Schiff. (Nymphalidae) in Mähren; Ztschr. f. Lepidopterologie, 1: 106—106, Krefeld.

Hormuzaki K., 1893: Aufzählung der bisher aus dem Königreiche Rumänien bekannten Tagfalter, mit Berücksichtigung der Nachbarländer, nebst Nachtrag; Ent. Nachrichten, 19: 240—246, 265—283, 304—304, Berlin.

Hormuzaki K., 1897a: Die Schmetterlinge (Lepidoptera) der Bukowina, 1. Theil; Verh. d. k.-k. zool.-bot. Ges. in Wien; 47: 70—103, Wien.

Hormuzaki K., 1897b: Die Schmetterlinge (Lepidoptera) der Bukowina, 2. Theil. Die bisher aus der Bukowina bekannt gewordenen Schmetterlinge (Lepidoptera); Ibid., 47: 126—168, 233—246, 312—341, 49 (1899): 32—86, Wien.

Hormuzaki K., 1902a: Über die in den Karpathen einheimischen Arten der Gattung Erebia Dalm. und deren Beziehungen zur pleistocänen Fauna Mitteleuropas; Deutsche Ent. Ztschr. (Lepidopterologische Hefte), 14: 353—380, Dresden. — Etiam in: Bull. Soc. Sc. 11: 318—347, Bucureşti.

Hormuzaki K., 1902b: Neuere Macrolepidopteren-Funde aus Rumänien; Verh. d. k.-k. zool.-bot. Ges. in Wien, 52: 563—567, Wien.

Hormuzaki K., 1906: Nachträge und Berichtigungen zur Macrolepidopterenfauna der Bukowina; Ibid., 56: 409—409, Wien.

Hormuzaki K., 1929: Grundlinien für die Biogeographie und Biogenese der Europäischen Macrolepidopteren; Bul. Fac. St. din Cernăuţi, 3: 111—159, Cernăuţi.

Horváth G. & J. Pável, 1876: Magyarország nagy-pikkelyröpüinek rendszres néojegyzéke. Ennumeratio Macrolepidopterorum Hungariae; Mathem. és természettud. Közlem., 12 (1874): 25—74, Budapest.

Husz A., 1881: Eperjes környékének nagy-pikkelyröpüi (Macrolepidoptera). Die Groß-Schmetterlinge (Macrolepidoptera) der Umgebung von Eperjes; A Magyarországi Kärpátegyesület Évkönyve — Jahrb. d. Ung. Karpathen-Vereines, 8: 238—302, Késmárk.

Jones A. H., 1907: Lepidoptera in Hungary in June; The Ent. Record and Journal of Var., 19: 245—247, London.

KUNTZE R. & J. NOSKIEWICZ, 1938: Zarys zoogeografii Polskiego Podola. Versuch einer Zoogeographie des polnischen Podoliens; Prace naukowe wydawnictwo Towarzystwa naukowego we Lwowie, IV: 1—538 (134), Lwów.

De LATTIN G., 1950: Türkiye Kelebecleri Hakkinda I. Türkische Lepidopteren I.; Istanbul Universitesi fen Fakültesi mesmuasi (Revue de la Faculté des Sciences de l'Université d'Istanbul, 15: 301—331, Levha (Tafel) I.—II., Instanbul.

LAZAREVIĆ R., 1897: Prilozi za gradju Entomologije Kraljevine Srbije, I. Macrolepidoptera okoline Beograda, I. Rhopalocera, Beograd.

LEMBERK F., 1939: Některé vzácnější nálezy Lepidopter v okolí Senorad, pol. okres Třebíč (with English summary); Ent. listy (Folia entomologica), 2 (1938—39): 119—119, Brno.

MANN J., 1866: Aufzählung der im Jahre 1865 in der Dobrudscha gesammelten Schmetterlinge; Verh. d. k.-k. zool.-bot. Ges. in Wien, 16: 321—360, Wien.

MANN J., 1869: Lepidopteren gesammelt während dreier Reisen nach Dalmatien in den Jahren 1850, 1862 und 1868; Ibid., 19: 371—388, Wien.

MAŘAN J., 1949: Význam geografické variability hmyzích druhů pro řešení otázek zoogeografických a vývojových. Le rôle important de la variation géographique des insectes pour les questions zoogéographiques et évolutives; Sborník entom. odděl. Nár. mus. v Praze (Acta Entomologica Mus. Nat. Pragae), 23 ("1945"): 23—87, 1 tab., 12 fig., Praha.

MÉRY E., 1874: A megye állatvilága (Pillangók). In: Fehér Ipoly, Györmegye és város egyetemi leirása, 1874: 133—157.

MOCSÁRY S., 1875: Adatok Biharmegye faunájához. Jélentés az 1872-ik év nyarán e megye területén tett állatani kutatás és gyüjtés eredményeiröl; Mathem. és természettud. Közlem., 10 (1872): 163—200, Budapest.

MOCSÁRY S., 1876: Biharmegye téhely- és pikkelyröpüi; Ibid., 11 (1873): 95—156, Budapest.

MOUCHA J., 1949: Motýl Argynnis pandora Schiff. na jihu Slovenska (with English summary); Vesmír 1948—49: 98—99, Praha.

MOUCHA J. & D. WEISS, 1951: Příspěvek k poznání fauny reservace na Kováčovských kopcích a v nejbližším okolí města Štúrova. Vnos dlja oznakomlenija s faunoj zapovednika v Kovačovskich cholmach i v okrestnostjach goroda Šturovo; Ochrana přírody (Naturae tutela) 6: 73—75, 3 fig., Praha.

NENDTVICH F., 1846: Pécsnek lepkéi és vidékökhezi viszonyaik; A Magyar orv. és természet. munkálatai, 1846: 305—308, Budapest.

NITSCHE J., 1919: Argynnis paphia L. und Argynnis pandora Schiff.; Jahres-Bericht d. Wien. entom. Vereines, 29 (1918): 3—5, Wien.

ORTVAY T., 1902: Pozsonyvármegye és á területén fekvö Pozsony, Nagyszombat, Bazin, Modor e Szentgyörgy városok Állatvillága. Elsö kötet, Allatrajzi rész, Pozsony.

PAWLITSCHEK A., 1902: Einige Eigenthümlichkeiten der bukow. Insektenfauna mit besonderer Rücksichtnahme auf Schmetterlinge und Käfer; Jahresber. d. k.-k. Staatsgymnasiums in Czernowitz (1901—02): 3—21, Czernowitz.

PAZSICZKY J., 1910: Adatok Trenczénmegye lepkefaunajához. A Trenczén vármegyei Természettudományi egylet Évkönyve — Jahresheft d. Naturw. Ver. des Trencséner Komitates, 31—33 (1908—10): 41—82, Trencsén.

Pax F., 1907: Lepidopterenfauna der Rodnaer Alpen; Jahresber. d. Schles. Ges. f. vaterl. Cult., 84 (1906): 45—53, Breslau.

Petricskó J., 1892: Selmeczbánya vidéke állatani tikintetben. Sélmeczbánya monografiája; Természettud. rész, 2: 102—113, Selmeczbánya.

Ponec J., 1950: Motýl Argynnis maja Cr. (pandora Schiff.) v Malých Karpatoch; Príroda, 5 (1949—50): 117—117, Turč. Sv. Martin.

Popescu A., 1938: Noui contribuţiuni la fauna Lepidopterelor din Bucureşti şi împrejurimi; Acad. Româna, Memoriile Secţiunii Ştiintifice, 14: 81—104 (1—24 p. sep.), Bucureşti.

Popescu A., 1939: Câteva Lepidoptere recoltate in luna August in jurul Comunei Mihai-Bravu; Buletinul Soc. Studenţilor Naturalişti, 8—10 (1—5 p. sep.), Bucureşti.

Povolný D., 1945: Příspěvky k poznání motýlů hadcové stepi u Mohelna a jejího okolí. (Beiträge zur Kenntnis der Falterfauna der Serpentinsteppe bei Mohelno und ihrer Umgebung.); Ent. listy (Folia entomologica), 8: 30—38, Brno.

Pronin G., 1928: Lepidopterologische Skizzen IV. Zur Lepidopterenfauna des Bosporus; Lep. Rundschau 2: 89—92, Wien.

Prüffer J., 1933(?): Próba charakterystyki fauny okolic Częstochowy na podstawie analizy rozmieszczenia motyli w pasmie Jury Krakowsko-Wieluńskiej. (Versuch einer Charakteristik der Fauna der Umgebung von Częstochowa auf Grund einer Analyse der Verbreitung von Schmetterlingsarten des Jurahöhenzuges von Krakau-Wieluń); Zemia Częstochowska (1933?): 1—38 (p. sep.), Częstochowa.

Rebel H., 1903: Studien über die Lepidopterenfauna der Balkanländer. I. Teil. Bulgarien und Ostrumelien; Ann. d. k.-k. Naturhist. Hofmus., 18: 123—347, Wien.

Rebel H., 1904: Studien über die Lepidopterenfauna der Balkanländer. II. Teil. Bosnien und Herzegowina; Ibid., 19: 97—377, Wien.

Rebel H., 1910: Beitrag zur Lepidopterenfauna der Ionischen Inseln; Verh. d. k.-k. zool. bot. Ges. in Wien; Wien.

Rebel H., 1911a: Die Lepidopterenfauna von Herkulesbad und Orsova; eine zoogeographische Studie; Ann. d. k.-k. Naturhist. Hofmus., 25: 253—430, Wien.

Rebel H., 1911b: Lepidopteren aus dem Gebiete des Monte Maggiore in Istrien; Jahres-Bericht d. Wiener entom. Vereines, 21 (1910): 97—110, Wien.

Rebel H., 1913a: id. op., II. Nachtrag; Ibid., 23 (1912): 176—205, Wien.

Rebel H., 1913b: Studien über die Lepidopterenfauna der Balkanländer. III. Teil. Sammelergebnisse aus Montenegro, Albanien, Mazedonien und Thrazien; Ann. d. k.-k. Naturhist. Hofmus., 27: 281—334, Wien.

Rebel H. & H. Zerny, 1931: Die Lepidopterenfauna Albaniens (Mit Berücksichtigung der Nachbargebiete). Wissenschaftliche Ergebnisse der im Auftrage und mit Kosten der Akademie der Wissenschaften in Wien im Jahre 1918 entsendeten Expedition nach Nordalbanien: Aus den Denkschr. d. Akad. d. Wiss. in Wien, Math.-Naturw. Klasse, 103 Bd., Wien.

Romaniszyn J., 1929: Fauna motylów Polski (Fauna Lepidopterorum Poloniae), I. Prace monograficzne Kom. Fizjogr., 6: 1—555 (97); 1 tabl.; Polska Akademja Umiejętności w Krakowie, Krakow.

Rosa A. F., 1909: Collecting in Hungary; The Entomologist, 42: 108—112, London.

Rothschild N. Ch., 1912: Adatok Magyarország lepkefaunájához. Beiträge zur Lepidopterenfauna Ungarns; Rovartani Lapok 19: 167—180, Budapest.

RÓZSAY E., 1878: Pozsony és környéke nagy lepkéinek jegyzéke. Catalogus Lepidopterorum Posoniensium; A Pozsonyi kir kath. fögymn. Értesitöje az 1877—78 évröl: 3—15, Pozsony.

RŮŽIČKA A., 1931: Príspevok k sústavnému výskumu fauny Lepidopter na Slovensku (S poznámkami Emila Fritsche). Ein Beitrag zur systematischen Durchforschung der Lepidopterenfauna in der Slovakei (Mit Anmerkungen von Emil Fritsch); Sbor. prírodov. odboru Slov. vlastiv. muzea v Bratislave, 1924—1931: 69—86, Bratislava.

SALAY F., 1910: Katalog der Macrolepidopteren Rumäniens, mit Berücksichtigung der Nachbarländer in der Balkanhalbinsel; Bul. Soc. Ştienţe Buc., 19: 74—206, 465—616, Bucureşti.

SCHACK E., 1936: Mein erster Argynnis pandora Schiff.; Ent. Ztschr. 50 (1936—37): 125—128, Wien.

SCHAWERDA C., 1908: Bericht über lepidopterologische Sammelreise in Bosnien und in der Herzegowina; Jahres-Bericht d. Wiener entom. Vereines, 19: 85—126, Wien.

SCHAWERDA C., 1912: Sechster Nachtrag zur Lepidopterenfauna Bosniens und der Herzegowina; Verh. d. k.-k. zool.-bot. Ges. in Wien, 62: 138—148, Wien.

SEITZ A., 1906: Die Großschmetterlinge d. Erde (Die paläarkt. Tagfalter, p. 242), Stuttgart.

SEYER H., 1938: Einige Erlebnisse von meiner Jugoslavienfahrt und der Fang einer neuen Papilio podalirius L. — Monstrosität (partitus?); Ent. Rundschau, 55 (1937—38): 629—632, 1 fig., Stuttgart.

SIMONICS G. & E. VIDÁK, 1856: Oedenburg's Lepidopteren-Fauna mit vorangehenden kurzen Andeutungen für die Jugend über das Sammeln derselben; Programm des Benedictiner Obergymnasiums zu Oedenburg, veröffentlicht am Schlusze des Schuljahres 1856, pp. 3—23, Oedenburg.

SKALA H., 1912: Die Lepidopterenfauna Mährens; Verh. d. naturforsch. Vereines in Brünn, 50 (1911), Brünn.

SKALA H., 1914: Studien zur Zusammenfassung der Lepidopterenfauna der öster.-ung. Monarchie. I. Teil: Großschmetterlinge; Öster. Monatschr. f. d. grundlegenden naturw. Unterricht (1914—16), 157 pp., Wien.

SPULER A., 1908: Schmetterlinge Europas, I. (p. 31), Stuttgart.

STAUDER H., 1922: Die Schmetterlingsfauna der illyro-adriatischen Festland- und Inselzone; Ztschr. f. wiss. Insektenbiologie, 17: 83—92, Berlin.

SZENT-IVÁNY J., 1937: Beitrag zur Rhopaloceren-Fauna der Slowakei (ČSR); Ent. Ztschr. 51 (1937—38): 106—108, 121—124, Wien.

SZENT-IVÁNY J., 1938a: Quelques remarquables cas de la gradation chez les Macrolépidoptères dans le bassin des Carpathes. A gradáció néhány jellemzö esete nagy lépkéknél a Kárpáti medencében; Folia ent. Hungarica, 3: 63—69, Budapest.

SZENT-IVÁNY J., 1938b: A Gömöri medence nappali lepke faunája (resumen español); Ibid., 3: 154—160, Budapest.

SZENT-IVÁNY J., 1938c: Lépidopterológiai jegyzetek II. (with English summary); Ibid., 4 (1938—39): 3—5, Budapest.

THURNER J., 1938: Die Schmetterlinge der Ochrid-Gegend in Macedonien; Mitteilungen aus den königl. naturw. Instituten in Sofia-Bulgarien, 11 (1938), Sofija.

THURNER J., 1948: Die Schmetterlinge Kärntens und Osttirols; Mitt. d. naturw. Vereines f. Kärnten, 191 pp., Klagenfurt.

Todorova V. & P. Petkov, 1915: Macrolepidopternata fauna na Caribrodsko i Trnsko; Trud. na Bulg. Prirod. Družstvo, 7: 128—147, Sofija.

Török J., 1866: Debreczen rovarfaunája ismetetése. II. Lepidoptera; Magyar orvosok és természetvizsgálók munkálatai, 11: 266—271, Budapest.

Valenta V., 1940: Argynnis pandora Schiff. a jeho rozšíření na Slovensku (mit deutscher Zusammenfassung); Příroda 33: 161—163, Brno.

Vángel J., 1886: Adatok Trencsenmegye lepkefaunájához. Contributions à la faune des Lépidoptères du department de Trencsén; Rovartani Lapok, 3: 139—145, Budapest.

Verity R., 1950: Le Farfalle diurne d'Italia, 4: XXV, 1—381 (313—319), 14 fig., Firenze.

Vorbrodt C., 1930: Tessiner und Misoxer Schmetterlinge; Mit. der Schweizer. ent. Ges. (Bull. de la Soc. Ent. Suisse), 14 (1927—31): 199—396 (230), 2 Taf. (VIII—IX.), Bern.

Warnecke G., 1927: Zur Verbreitung von Argynnis pandora Schiff. in Deutschland; Ztschr. d. öster. Ent. Vereines, 12: 32—32, Wien.

Warren B. C. S., 1942: Genus Pandoriana Gen. Nov. A preliminary description; The Entomologist, 75: 245—246, Dorking.

Zerkowitz A., 1927: Beiträge zur Kenntnis der Lepidopterenfauna Ungarns; Int. Ent. Ztschr., 20 (1927): 17—64, Guben.

Zukowsky B., 1933: Ergänzung zur Schmetterlingsjagd auf dem Balkan von Dr Binder; Ibid., 27: 389—390, Guben.

Zukowsky B., 1935: Sammelfahrt ins bulgarische Mazedonien 1931 (Lep.); Ibid., 29: 3—5, 33—36, 70—72, Guben.

Zukowski B., 1937: Zwei Reisen nach Griechenland. I. Vjeluchigebirge 1932; Ent. Ztschr., 51: 109—113, 152—155, Wien.

A. S. [Alois Sterzl], 1931: Entomologische Notiz; Ztschr. Ver. Naturbeobachter und Sammler, 6: 8—8, Wien.